CLAIMS

We Claim:

1. A magnetic sensor for use with sense current applied substantially perpendicular to the plane of the layers in the sensor, comprising:

a first antiferromagnetic layer;

a pinned layer comprising an antiparallel pinned substructure formed on said first antiferromagnetic layer, said antiparallel pinned substructure comprising a first ferromagnetic layer, a nonmagnetic layer formed on said first ferromagnetic layer, and a second ferromagnetic layer formed on said nonmagnetic layer, wherein said first ferromagnetic layer is exchanged coupled to said first antiferromagnetic layer;

a nonmagnetic separation layer formed on said second ferromagnetic layer of said antiparallel pinned substructure;

a ferromagnetic free layer formed on said nonmagnetic separation layer; and,

a second antiferromagnetic layer supporting magnetic bias stabilization of said ferromagnetic free layer.

2. A magnetic sensor as in claim 1 wherein said first and second antiferromagnetic layers are made of the same material having substantially the same blocking temperature.

3. A magnetic sensor as in claim 2 wherein said nonmagnetic separation layer is formed from a conductive material.

4. A magnetic sensor as in claim 2 wherein the nonmagnetic separation layer is formed from an insulating material.

5. A magnetic sensor for use with sense current applied substantially perpendicular to the plane of the layers in the sensor, comprising:

a first antiferromagnetic layer;

a pinned first ferromagnetic layer formed on said first antiferromagnetic layer;

a first nonmagnetic separation layer formed on said pinned first ferromagnetic layer;

a free second ferromagnetic layer formed on said nonmagnetic separation layer;

an antiparallel pinned substructure coupled to said free layer, comprising a third ferromagnetic layer; and,

a second antiferromagnetic layer exchange coupled with said third ferromagnetic layer.

6. A magnetic sensor as in claim 5 wherein said antiparallel pinned substructure is coupled to said free ferromagnetic layer through a second nonmagnetic separation layer.

7. A magnetic sensor as in claim 5 wherein said antiparallel pinned substructure is coupled to a portion of said free ferromagnetic layer.

8. A magnetic sensor as in claim 5 wherein said first and second antiferromagnetic layers are made of the same material having substantially the same blocking temperature.

9. A magnetic sensor as in claim 5 wherein said first nonmagnetic separation layer is formed from a conductive material.

10. A magnetic sensor as in claim 5 wherein said first nonmagnetic separation layer is formed from an insulating material.

11. A magnetic sensor for use with sense current applied substantially perpendicular to the plane of the layers in the sensor, comprising:

a first antiferromagnetic layer;

a pinned first ferromagnetic layer formed on said first antiferromagnetic layer;

a first nonmagnetic separation layer formed on said pinned first ferromagnetic layer;

a free layer formed on said first nonmagnetic separation layer, said free layer comprising an antiparallel pinned substructure;

a second nonmagnetic separation layer formed on said free layer, and;

a second antiferromagnetic layer formed on second nonmagnetic separation layer.

12. A magnetic sensor as in claim 11 wherein said first nonmagnetic separation layer is formed from a conductive material.

13. A magnetic sensor as in claim 11 wherein said first nonmagnetic separation layer is formed from an insulating material.

14. A method of simultaneously initializing two antiferromagnetic layers in a magnetic sensor having an AP pinned substructure comprising a first ferromagnetic layer, a first antiferromagnetic layer exchange coupled to said

first ferromagnetic layer and a second antiferromagnetic layer supporting magnetic bias stabilization of the free layer, said magnetic sensor for use with sense current applied substantially perpendicular to the plane of the layers in the sensor, comprising:

placing the sensor in an external magnetic field;

adjusting the magnitude of said magnetic field to cause the magnetization of said first ferromagnetic layer in said AP pinned substructure to be substantially perpendicular to the external magnetic field direction;

heating the sensor above the blocking temperature of both said first and second antiferromagnetic layers; and,

cooling the sensor below the blocking temperature of both the first and second antiferromagnetic layer in the presence of said external magnetic field.

15. A method of simultaneously initializing the antiferromagnetic layers in a magnetic sensor which has a first antiferromagnetic layer exchanged coupled to a pinned layer and a second antiferromagnetic layer exchanged coupled to a ferromagnetic layer, said ferromagnetic layer comprising a portion of an AP pinned substructure supporting magnetic bias stabilization of a free layer, said magnetic

sensor for use with sense current applied substantially perpendicular to the plane of the layers in the sensor, comprising:

placing the sensor in an external magnetic field;

adjusting the magnitude of said external magnetic field to cause the magnetization of said ferromagnetic layer in said antiparallel pinned substructure to be substantially perpendicular to the external magnetic field direction;

heating the sensor above the blocking temperature of both said first and second antiferromagnetic layers; and,

cooling the sensor below the blocking temperature of both the first and second antiferromagnetic layer in the presence of said external magnetic field.

16. A magnetic storage system, comprising:

a magnetic storage medium for the recording of data;

a motor connected with said magnetic storage medium;

a slider having a magnetic recording head assembly maintained in close proximity to the storage medium during relative motion between said head assembly and said storage medium, said recording head assembly having a magnetic sensor comprising,

a first antiferromagnetic layer;

a pinned layer formed on said first antiferromagnetic layer, wherein said pinned layer comprises an AP pinned substructure;

a nonmagnetic separation layer formed on said pinned layer;

a free layer formed on said nonmagnetic separation layer;

a second antiferromagnetic layer supporting bias stabilization of said free layer; and,

a suspension connected to said slider which positions said slider for magnetic recording on the disk;

wherein said first and second antiferromagnetic layers are made of the same material having substantially the same composition and having substantially the same blocking temperature.

17. A magnetic storage system as in Claim 16 wherein said nonmagnetic separation layer is formed from a conductive material.

18. A magnetic storage system as in Claim 16 wherein said nonmagnetic separation layer is formed from an insulating material.

19. A magnetic storage system, comprising:

a magnetic storage medium for the recording of data;

a motor connected to said magnetic storage medium;

a slider having a magnetic recording head assembly maintained in close proximity to the storage medium during relative motion between said head assembly and said storage medium, said recording head assembly having a magnetic sensor comprising,

a first antiferromagnetic layer;

a ferromagnetic pinned layer exchange coupled to said first antiferromagnetic layer;

a nonmagnetic separation layer formed on said pinned layer;

a free second ferromagnetic layer formed on said nonmagnetic separation layer;

one or more bias tabs coupled to a portion of said free layer, said bias tabs comprising an AP pinned substructure exchange coupled to a second antiferromagnetic layer, said bias tabs providing magnetic bias stabilization of said free layer,

wherein said first and second antiferromagnetic layers are made of the same material having substantially the same composition and having substantially the same blocking temperature; and,

a suspension connected to the slider which positions said slider for magnetic recording on the disk.

20. A magnetic storage system as in Claim 19 wherein said nonmagnetic separation layer is formed from a conductive material.

21. A magnetic storage system as in Claim 19 wherein said nonmagnetic separation layer is formed from a insulating material.